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WHAT IS CLAIMED IS:

1. A zone arc fault detection system for detecting arcing faults in a defined zone of an electrical circuit, such as an aircraft circuit, comprising:

a pair of substantially identical parallel insulated conductors for each zone in which arcing is to be detected, thereby defining a detection zone comprising the length of said parallel conductors between end points where the two conductors are coupled together;

a current sensor operatively associated with each said pair of parallel conductors, said current sensor and said conductors being respectively configured and arranged such that the current sensor produces a signal representative of a difference in current between the two conductors.

- 2. The system of claim wherein said current sensor comprises a current transformer having a high permeability core.
- 3. The system of claim 1 wherein said current sensor comprises a Hall effect sensor.
- 4. The system of claim 1 wherein said current sensor comprises a low magnetic permeability di/dt current sensor.
 - 5. The system of claim 4 wherein said current sensor comprises an air core toroid.
 - 6. The system of claim 5 wherein said current sensor comprises a flexible Rogowski coil formed into a figure 8 donfiguration.
 - 7. The system of claim 4 wherein the current sensor produces a signal proportional to the difference between the time derivatives of the current in each conductor and further including a circuit for integrating and filtering said sensor signal to produce a signal proportional to the current difference between said conductors.

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8. The system of claim wherein said current sensor comprises a resistive shunt constructed so as to produce a voltage difference proportional to the difference in current between said conductors.

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The system of claim 1 wherein said current sensor comprises a magnetic core, said conductors being operatively coupled with conductors wound around a magnetic core such that magnetic fields of said-conductors oppose each other.

- 10. The system of claim 9 and further including an armature attracted by said magnetic core in response to a current difference in said conductors.
 - 11. The system of claim 1 wherein said current sensor comprises a differential current sensor which produces a predetermined motion in response to the current difference between the conductors.

12. The system of claim 11 wherein said differential current sensor comprises a bi-metal element.

- 13. The system of claim 1 and further including a fault detector circuit operatively coupled with said current sensor.
 - 14. The system of claim 13 and further including a circuit breaker responsive to said fault detector circuit.
 - 15. The system of claim 1 and further including a circuit breaker responsive to said differential current.
 - 16. The system of claim 1 and further including a relay operatively coupled with said circuit breaker, said relay being responsive to said differential current for operating said circuit breaker.

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17. A method for detecting arcing faults in a defined zone of an electrical circuit, such as an aircraft circuit, comprising:

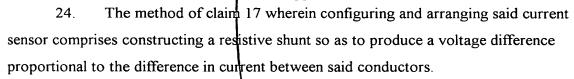
splitting a conductor in each said defined zone into a pair of substantially identical parallel insulated conductors, thereby defining a detection zone comprising the length of said parallel conductors between end points where the two conductors are coupled together;

providing a current sensor operatively associated with each said pair of parallel conductors; and

configuring and arranging a current sensor and said conductors such that the current sensor produces a signal representative of a difference in current between the two conductors.

- 18. The method of claim 17 wherein said current sensor comprises a current transformer having a high permeability core.
- 19. The method of claim 17 wherein said current sensor comprises a Hall effect sensor.
- 20. The method of claim 17 wherein said current sensor comprises a low magnetic permeability di/dt current sensor.
 - 21. The method of claim 20 wherein said current sensor comprises an air core toroid.
 - 22. The method of claim 21 wherein said current sensor comprises a flexible Rogowski coil formed into a figure 8 configuration.
 - 23. The method of claim 20, including producing a signal proportional to the difference between the time derivatives between the current in each conductor and further including integrating and filtering said sensor signal to produce a signal proportional to the current difference between said conductors.

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- The method of claim 17 wherein configuring and arranging said current sensor comprises coupling said conductors with conductors wound in opposite directions around a magnetic core.
- 26. The method of claim 25 wherein configuring and arranging said current further includes providing an armature attracted by said magnetic core in response to a current difference in said conductors.
 - 27. The method of claim 17 wherein configuring and arranging said current sensor comprises providing a differential current sensor which produces a predetermined motion in response to the current difference between the conductors.
 - 28. The method of claim 27 wherein said differential current sensor comprises a bi-metal element.
- 29. The method of claim 17 and further including coupling a fault detector circuit with said current sensor.
 - 30. The method of claim 29 and further including providing a circuit breaker coupled for response to said fault detector circuit.
 - 31. The method of claim 17 and further including providing a circuit breaker coupled for response to said differential current.
- 32. The method of claim 17 and further including operatively coupling a relay with said circuit breaker for responding to said differential current for operating said circuit breaker.

